Understanding Art through Multi-Modal Retrieval in Paintings

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Motivation

We aim to understand art beyond its visual appearance.

View of Florence from Villa San Firenze, near San Miniato

This view of Florence is one of a number of views by Lear based upon on the spot sketches he produced in 1861.
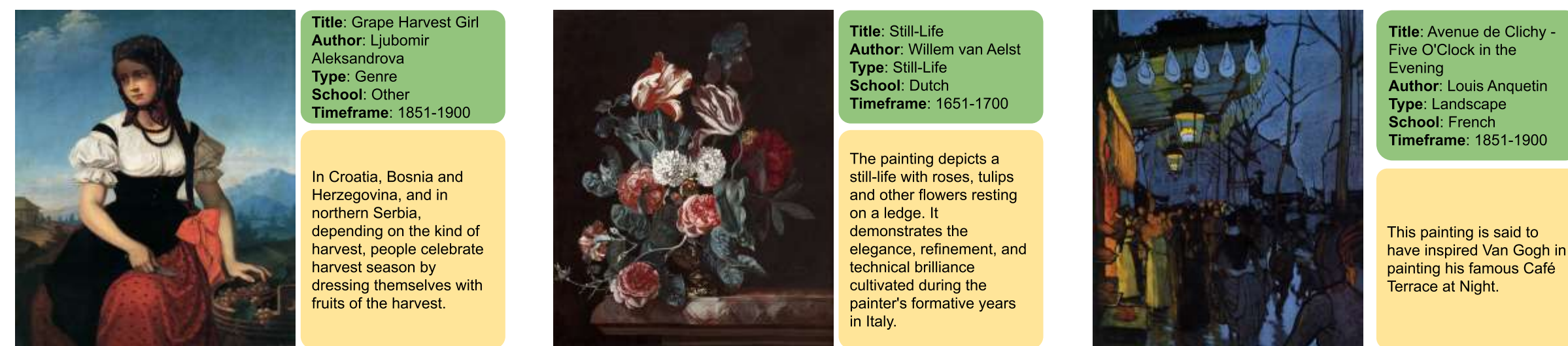
Water Carriers

This painting was inspired by the painter's travels in Italy. The costume of the two girls and the landscape suggests the Amalfi coast, or Capri as the setting of the scene.

Can we identify the painting an artistic comment belongs to?

- We capture **semantics** with robust representations.
- **Contextual** information informs the model to boost results.

SemArt Dataset

Title: Grape Harvest Girl
Author: Ljubomir Aleksandrova
Type: Genre
School: Other
Timeframe: 1851-1900

In Croatia, Bosnia and Herzegovina, and in northern Serbia, depending on the kind of harvest, people celebrate harvest season by dressing themselves with fruits of the harvest.

Title: Still-Life
Author: Willem van Aelst
Type: Still-Life
School: Dutch
Timeframe: 1651-1700

The painting depicts a still-life with roses, tulips and other flowers resting on a ledge. It demonstrates the elegance, refinement, and technical brilliance cultivated during the painter's formative years in Italy.

Title: Avenue de Clichy - Five O'Clock in the Evening
Author: Louis Anquetin
Type: Landscape
School: French
Timeframe: 1851-1900

This painting is said to have inspired Van Gogh in painting his famous Café Terrace at Night.

- Corpus with **21,384 reproductions** of European paintings.
- Painting associated to **natural language comment**.
- With **attributes**: author, title, date, techniques, type, school, timeframe.
- Evaluation as multimodal retrieval task:
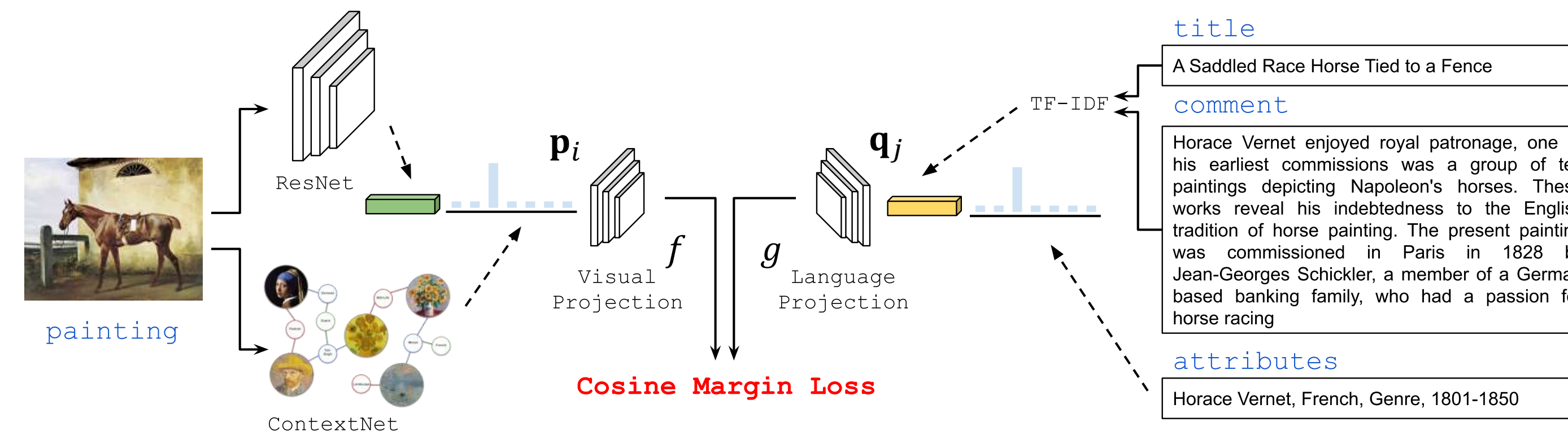
text → image and **image → text**

Multi-Modal Representations in Art

Language representation:
1. Comments and titles encoded as TFIDF vectors.
2. Language attributes encoded as one-hot vector.

Visual representation:
1. Paintings encoded with a ResNet50.
2. Visual attributes predicted with ContextNet.

title
A Saddled Race Horse Tied to a Fence

comment
Horace Vernet enjoyed royal patronage, one of his earliest commissions was a group of ten paintings depicting Napoleon's horses. These works reveal his indebtedness to the English tradition of horse painting. The present painting was commissioned in Paris in 1828 by Jean-Georges Schickler, a member of a German based banking family, who had a passion for horse racing.

attributes
Horace Vernet, French, Genre, 1801-1850

$$\text{Loss}(\mathbf{p}_i, \mathbf{q}_j) = \begin{cases} 1 - \text{sim}\big(f(\mathbf{p}_i), g(\mathbf{q}_j)\big), & \text{if } i = j \\ \max\big(0, \text{sim}\big(f(\mathbf{p}_i), g(\mathbf{q}_j)\big) - \Delta\big), & \text{if } i \neq j \end{cases}$$

ContextNet for Attribute Prediction
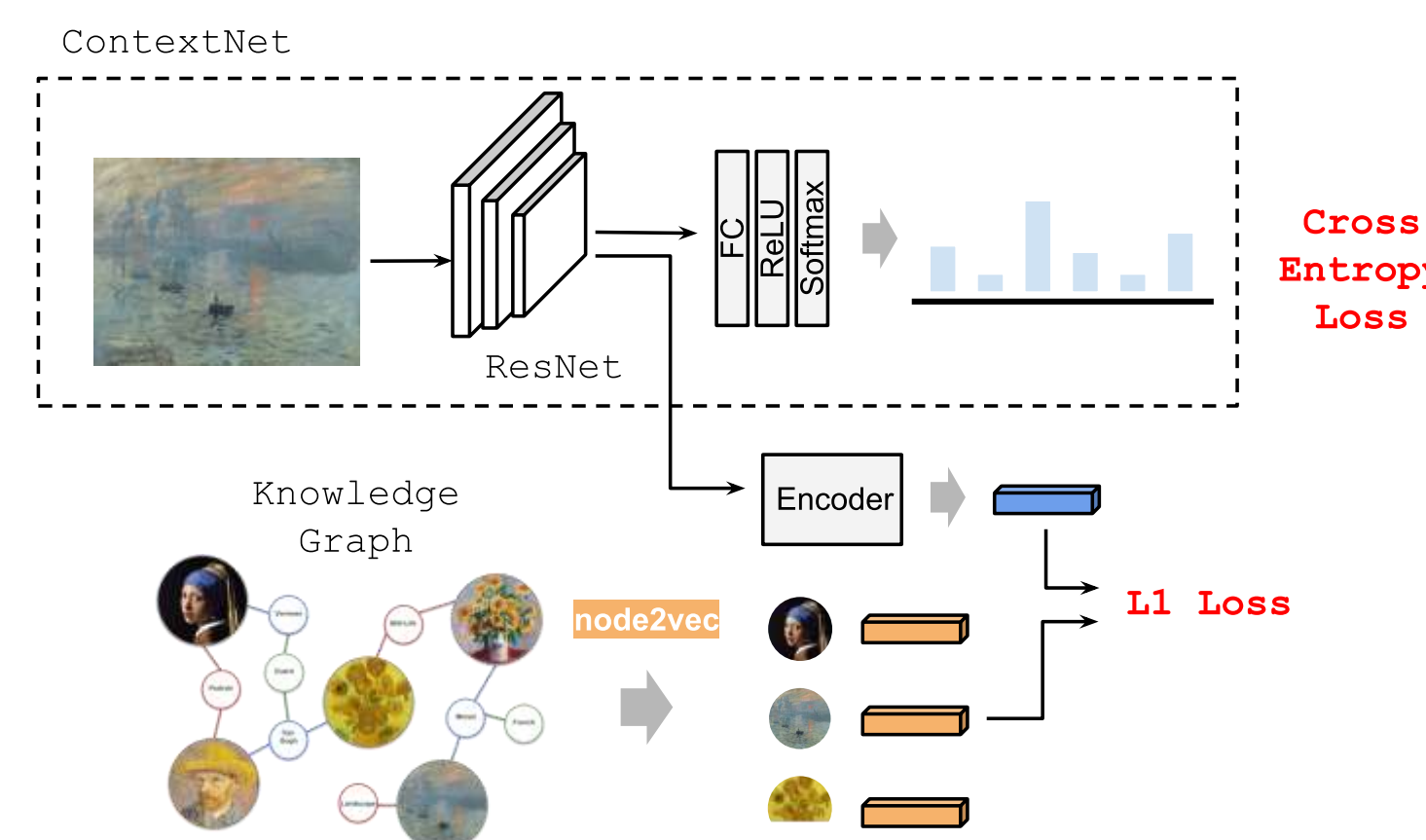
- Knowledge Graph (KG) with paintings and attributes.
- Paintings in KG encoded into graph embeddings (GE).
- GE enhance ResNet features during training.
- Enhanced ResNet used to predict artistic attributes.

Evaluation

Encoding	Text → Image				Image → Text			
	R@1	R@5	R@10	MR	R@1	R@5	R@10	MR
Vis&Lang	0.164	0.384	0.505	10	0.162	0.366	0.479	12
Att TYPE	0.178	0.383	0.525	9	0.165	0.364	0.491	11
Att SCHOOL	0.192	0.386	0.507	10	0.163	0.364	0.484	12
Att TF	0.127	0.322	0.432	18	0.130	0.336	0.444	16
Att AUTHOR	0.236	0.451	0.572	7	0.204	0.440	0.535	8
Att&ContextNet TYPE	0.152	0.367	0.506	10	0.147	0.367	0.507	10
Att&ContextNet SCHOOL	0.162	0.371	0.483	12	0.156	0.355	0.483	11
Att&ContextNet TF	0.175	0.399	0.506	10	0.148	0.360	0.472	12
Att&ContextNet AUTHOR	**0.247**	**0.477**	**0.581**	**6**	**0.212**	**0.446**	**0.563**	**7**

Title: Portrait of a Girl
Comment: This painting shows a girl in a yellow dress holding a bouquet of flowers. It is a typical portrait of the artist showing the influence of his teacher, Agnolo Bronzino.

Title: A Saddled Race Horse Tied to a Fence
Comment: Horace Vernet enjoyed royal patronage, one of his earliest commissions was a group of ten paintings depicting Napoleon's horses. These works reveal his indebtedness to the English tradition of horse painting. The present painting was commissioned in Paris in 1828 by Jean Georges Schickler, a member of a German based banking family, who had a passion for horse racing.

References

N. Garcia, G. Vogiatzis. How to Read Paintings: Semantic Art Understanding with Multi-Modal Retrieval. ECCVW 2018.

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